EM Basic- Pulmonary Embolism Part 1- Risk factors, Symptoms, and Testing

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Pathophys- PE is usually from a clot in the deep veins of the lower extremities or pelvis and has travelled or embolized to the pulmonary vasculature. (Clots in upper extremity much less worrisome for PE- but its a whole other topic for another podcast)

Clot lodges into pulmonary artery --> increased pulmonary vasculature resistance --> decreased in preload.

Section of lung supplied by that pulmonary artery branch can’t oxygenate --> hypoxia and chest pain

Clot causes mechanical obstruction of pulmonary artery --> backpressure on the right side of the heart --> left sided heart failure --> hypotension and shock

Virchow’s triad- hypercoagulability, stasis, and vascular injury
Hypercoagulability- usually inherited diseases like Factor V Leiden, Protein C and S deficiency, also cancer
Stasis- staying still for a long period of time
Vascular Injury- some sort of injury to vascular basement membrane to form clot- while trauma does put pts at risk, doesn’t have to be present-older pts (over 60) have older vasculature that is prone to “injury”

PEARL- don’t need to identify all 3 factors to be at risk for a PE, this is the “classic” presentation

Major PE risk factors
Intrinsic clotting disorders- Factor V Leiden, Protein C and S deficiency (usually know this only if pt knows they have a history of it)
Recent surgery/trauma
Pregnancy
Oral contraceptive pills (or any estrogen)
Cancer
History of previous PE/DVT
Advancing age (over 60)
Autoimmune disease (especially lupus)

Symptoms of PE- classic “triad” is hemoptysis (present only 2.9% of time), chest pain (47%), and shortness of breath (79%)

Pleuritic chest pain- sharp stabbing chest pain in a broad area that is worse with deep breathing, coughing, or talking

Vital sign abnormalities- tachycardia, hypoxia, hypotension (sign of severe disease)

PEARL- take into consideration the whole picture with risk factors, si and symptoms when deciding whom to workup for PE

Gestalt- “unstructured assessment that the patient has the disease base on the pre-test probability in light of the clinician’s clinical experience and the available information”- AKA your “guy feeling”

High risk patient (theoretical example)- A pregnant female with a history of factor V Leiden who just got off a long plane flight with a unilateral swollen leg with chest pain, hemoptysis, shortness of breath, hypoxia, tachycardia, and hypotension

Low risk patient- A few minutes of chest pain in a 20 year old female with no PE risk factors (including OCP) without any vital sign abnormalities

Medium risk patient (debatable- everyone has their own definition)- A 25 year old female on OCPs with some sharp chest pain that lasted few hours with some shortness of breath now resolved, heart rate 105

PEARL- Gestalt can still be used with good accuracy even as a novice learner- one study- 1st year residents had 71% accuracy for PE diagnosis 74% for 2nd and 3rd year residents, and 78% for 4th year residents and attendings- only a 7% increase in accuracy from intern to attending

PERC rule (see essential evidence episode for a “deep dive” on this)

First step- decide that the patient is low risk based on gestalt- language of study was “a low enough risk that a board certified EM physician would be comfortable ruling out the diagnosis of PE if the d-dimer was negative”- approximately 15%
If medium or high risk - proceed immediately to advanced imaging (CT or V/Q)

If low risk by gestalt - apply the PERC rule

Mnemonic - BREATHS

Blood in the sputum (hemoptysis)  
Room air sat less than 95%  
Estrogen use (OCPs or other estrogens)  
Age greater than 50  
Thrombosis - either a PE/DVT in the past or current suspicion of a DVT  
Surgery or trauma in the past 4 weeks

If all negative - stop the workup for PE - risk of PE is 1.6%, risk of harms from testing and treatment of DVT 1.8% - will cause more harm than benefit if you test these patients

If any of those criteria are positive - do a D-dimer  
If D-dimer is negative - stop the workup for PE  
If D-dimer is positive - get advanced imaging

Other decision rules - Well’s, Revised Geneva - not as commonly used

Workup for PE (after using a clinical decision rule)

CT Pulmonary Angiogram - CTPA or CTA for short

-Quick and easy to obtain in most EDs, very accurate and reveals other possible diagnoses that could cause chest pain/shortness of breath

-Limitations - patients with renal failure, patient exceeds the weight limit of the CT table, pregnancy (relative limitation - see below)

V/Q scan - IV radioactive tracer is injected to examine pulmonary vasculature followed by inhaling a radioactive tracer, if a lung segment ventilates but does not perfuse, it suggests a PE

-Limitations - much less accurate than CT, does not reveal alternate diagnoses, Chest x-ray needs to be completely clear for it to be useful

Advanced imaging

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Troponin - useful for risk stratifying patients with PE once it is diagnosed

HCG - in all females of child bearing age

D-dimer - measures the degradation products of cross-linked fibrin - don't order this without using a clinical decision rule first! Only for low risk patients! Very sensitive for PE (95%) but false positives as high as 50-70% - causes a lot of unnecessary testing if ordered indiscriminately. D-dimer also increases with pregnancy to the point where it really isn’t useful

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-Only useful if the test is read as completely negative/normal - a “low probability” of PE still has a risk of PE of 20% (way too high)
Bilateral lower extremity ultrasounds- in a patient with signs and/or symptoms suggestive of PE, a clot in the legs pretty much equals a clot in the lungs- however, if negative it’s not helpful at all- can be used in pregnancy as an option but usually prefer better confirmation in form of CT or V/Q scan

Advanced Imagining for PE in Pregnancy

CTA

-PROS- in pregnancy, even one abdominal CT is still below known threshold of harm for radiation for the fetus so radiation should not be a concern, can adjust CT scanner settings to avoid scanning into the abdomen

-CONS- concern over radiation exposure, more non-diagnostic CT scans in pregnancy due to physiologic changes (changes in blood volumes and cardiac output), harms of contrast exposure in pregnancy for fetus (not proven in literature but likely never to get a good answer on this)

V/Q scan

-PROS- if chest x-ray is normal then higher rate of diagnostic scans compared to CT, much less radiation exposure

-CONS- not as accurate as CT, radioactive tracer concentrates in the bladder which is right next to the uterus (can have patient urinate immediately after scan to reduce radiation exposure)

PEARL- follow your institution’s guidelines in regards to choice of test and consenting patients for PE imaging in pregnancy. Go through the pros and cons of whatever imaging you choose and have the patient sign a consent form after a frank discussion of all the risks and benefits

PEARL- PE is a serious disease in pregnancy- you can’t not pursue the diagnosis because the workup may be difficult

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